

**WHAT IS CLAIMED IS:**

1                   1. In an application requiring the conduction of heat between an  
2 exothermic device and a heat sink surface, the improvement comprising interposing between  
3 said exothermic device and said heat sink surface a heat-spreading layer of a composite  
4 comprised of carbon nanotubes dispersed in a matrix of ceramic material, said composite  
5 having been uniaxially compressed in a direction transverse to said heat sink surface.

1                   2. The improvement of claim 1 in which said composite is the product of  
2 a process comprising consolidating a mixture of ceramic particles of less than 500 nm in  
3 diameter and carbon nanotubes into a continuous mass by uniaxially compressing said  
4 mixture while passing a pulsed electric current through said mixture.

1                   3. The improvement of claim 1 in which said composite has a density of  
2 at least 90% relative to a volume-averaged theoretical density.

1                   4. The improvement of claim 1 in which said composite has a density of  
2 at least 95% relative to a volume-averaged theoretical density.

1                   5. The improvement of claim 1 in which said composite has a density of  
2 at least 98% relative to a volume-averaged theoretical density.

1                   6. The improvement of claim 1 in which said composite has a density of  
2 at least 99% relative to a volume-averaged theoretical density.

1                   7. The improvement of claim 1 in which said carbon nanotubes are  
2 predominantly single-wall carbon nanotubes.

1                   8. The improvement of claim 1 in which said carbon nanotubes constitute  
2 from about 1% to about 50% of said composite by volume.

1                   9. The improvement of claim 1 in which said carbon nanotubes constitute  
2 from about 2.5% to about 25% of said composite by volume.

1                   10. The improvement of claim 1 in which said carbon nanotubes constitute  
2 from about 5% to about 20% of said composite by volume.

1                   **11.**    The improvement of claim **1** in which said ceramic material is a metal  
2   oxide selected from the group consisting of alumina, zirconia, magnesium oxide, magnesia  
3   spinel, zirconia, titania, cerium oxide, chromium oxide, and hafnium oxide.

1                   **12.**    The improvement of claim **1** in which said ceramic material is alumina.

1                   **13.**    The improvement of claim **1** in which said ceramic material is alumina  
2   and said carbon nanotubes are predominantly single-wall carbon nanotubes constituting from  
3   about 5% to about 25% of said composite.

1                   **14.**    The improvement of claim **2** in which said process comprises  
2   uniaxially compressing said mixture at a pressure of from about 10 MPa to about 200 MPa  
3   and a temperature of from about 800°C to about 1,500°C, and said sintering electric current is  
4   a pulsed direct current of from about 250 A/cm<sup>2</sup> to about 10,000 A/cm<sup>2</sup>.

1                   **15.**    The improvement of claim **2** in which said process comprises  
2   uniaxially compressing said mixture at a pressure of from about 40 MPa to about 100 MPa  
3   and a temperature of from about 900°C to about 1,400°C, and said sintering electric current is  
4   a pulsed direct current of from about 500 A/cm<sup>2</sup> to about 5,000 A/cm<sup>2</sup>.

1                   **16.**    The improvement of claim **1** in which said exothermic device is a  
2   microprocessor.

1                   **17.**    A structural component requiring thermal insulation in high-  
2   temperature environments, said structural component comprising a substrate coated with a  
3   thermal barrier coating of a composite comprising carbon nanotubes dispersed in a matrix of  
4   ceramic material, said composite having been uniaxially compressed in a direction transverse  
5   to said surface.

1                   **18.**    The structural component of claim **17** in which said composite is the  
2   product of a process comprising consolidating a mixture of ceramic particles of less than  
3   500 nm in diameter and single-wall carbon nanotubes into a continuous mass by compressing  
4   said mixture while passing a pulsed electric current through said mixture.

1                   **19.**    The structural component of claim **17** in which said composite has a  
2   density of at least 95% relative to a volume-averaged theoretical density.

1                   **20.**    The structural component of claim 17 in which said composite has a  
2 density of at least 98% relative to a volume-averaged theoretical density.

1                   **21.**    The structural component of claim 17 in which said composite has a  
2 density of at least 99% relative to a volume-averaged theoretical density.

1                   **22.**    The structural component of claim 17 in which said carbon nanotubes  
2 are predominantly single-wall carbon nanotubes.

1                   **23.**    The structural component of claim 17 in which said carbon nanotubes  
2 constitute from about 1% to about 50% of said composite by volume.

1                   **24.**    The structural component of claim 17 in which said carbon nanotubes  
2 constitute from about 2.5% to about 25% of said composite by volume.

1                   **25.**    The structural component of claim 17 in which in which said carbon  
2 nanotubes constitute from about 5% to about 20% of said composite by volume.

1                   **26.**    The structural component of claim 17 in which said ceramic material is  
2 a metal oxide selected from the group consisting of alumina, zirconia, magnesium oxide,  
3 magnesia spinel, zirconia, titania, cerium oxide, chromium oxide, and hafnium oxide.

1                   **27.**    The structural component of claim 17 in which said ceramic material is  
2 alumina.

1                   **28.**    The structural component of claim 17 in which said ceramic material is  
2 alumina and said carbon nanotubes are predominantly single-wall carbon nanotubes  
3 constituting from about 5% to about 25% of said composite.

1                   **29.**    The structural component of claim 18 in which said process comprises  
2 uniaxially compressing said mixture at a pressure of from about 10 MPa to about 200 MPa  
3 and a temperature of from about 800°C to about 1,500°C, and said sintering electric current is  
4 a pulsed direct current of from about 250 A/cm<sup>2</sup> to about 10,000 A/cm<sup>2</sup>.

1                   **30.**    The structural component of claim 18 in which said process comprises  
2 uniaxially compressing said mixture at a pressure of from about 40 MPa to about 100 MPa

3 and a temperature of from about 900°C to about 1,400°C, and said sintering electric current is  
4 a pulsed direct current of from about 500 A/cm<sup>2</sup> to about 5,000 A/cm<sup>2</sup>.

1                   **31.**       The structural component of claim 17 in which said structural  
2 component is a combustion gas turbine blade.